

ENVIRONMENT FRIENDLY WATER REPELLENT AND SOIL RELEASE FINISH WITH FLUORINE-FREE SOLUTIONS

SUTAPA CHOWDHURY¹, MD. MAHAMUDUL HASAN², KAWSER PARVEEN
CHOWDHURY³, RASHEDA BEGUM DINA⁴ & MD. KAMRUL HASAN⁵

¹Assistant Professor, Department of Textile Fashion & Design, Bangladesh University of Textiles, Dhaka, Bangladesh

^{2,5}Lecturer, Department of Textile Fashion & Design, Bangladesh University of Textiles, Dhaka, Bangladesh

^{3,4}Assistant Professor, Department of Wet Process Engineering, Bangladesh University of Textiles, Dhaka, Bangladesh

ABSTRACT

In modern world customer demands more value on garments through different levels of comfort, durability and functionality. These expectations have led to major opportunities for the textile industry in general and textile finishing in particular. Water /oil repellent finishes can provide durable liquid repellency (Water and Oil) without compromising the natural feel of cotton. With proper chemical treatments, judicious selection of specialty chemicals, fabric construction, fabric/ garments, a host of benefits to the wearer such as staying clean for a longer period, faster drying and protection from rain can be produced. Water repellent property of fabric was analyzed through AATCC method. In this research we used non-fluorocarbon-based chemical which is sourced from some variety of plant-based sources, selected to be from non-genetically-modified (non-GMO) and non-food-source feedstock. It also fully complies with Oeko-Tex Standard 100 requirements, and with the Zero Discharge of Hazardous Chemicals (ZDHC) Joint Roadmap Manufacturers Restricted Substance List (MRSL). In this thesis after the treatment of water, oil repellency and staining property and the test procedures are described with the laboratory testing result on knit fabric. In accordance with the design developed keeping in mind for the child who are generally engaged in water, oil and dust during playing on a regular basis.

KEYWORDS: Water Repellency, Treatment, Durability & Finishes

Received: May 15, 2018; **Accepted:** Jun 05, 2018; **Published:** Jun 30, 2018; **Paper Id.:** IJTFTAUG20182

INTRODUCTION

Durable water repellent (DWR) technology has historically been achieved with textile finishes that contain a polymer to which long-chain perfluoroalkyl groups have been attached or non-fluorinated finishes [1]. With proper chemical treatments, judicious selection of specialty chemicals, fabric construction, fabric/ garments, a host of benefits to the wearer such as staying clean for a longer period, faster drying and protection from rain can be produced[2].

Special treatment of fabric make ease in ironing, cleaning of the fabric. Researchers have made significant advances in finishing processes to ease soil removal, stain penetration etc. Water repellent finishing on these fabrics is mostly imparted by the incorporation of low surface energy compounds [2]. Durable water repellent, or DWR, is a coating added to fabrics at the factory to make them water-resistant (or Hydrophobic). Most factory-applied treatments are fluoro polymer based. Durable water repellents are commonly used in conjunction such as waterproof breathable fabrics such as Gore-Tex to prevent the outer layer of fabric from becoming saturated with water [3]. Fluorine-free DWR solutions are the future demand in water repellency finishes in the textile industry. These

finishes has no fluoro chemicals, making them ultimate environmentally-friendly solutions for garments requiring water repellency [4].

Fluorine-free coating will be a hydrophobic, self-assembled mesoporous structure that is environment friendly and will be applied using industry standard coating techniques, maintaining competitive production costs relative to other stain-resistant treatments [5].

Unlike finishes containing fluorine zeroF is based on raw materials which neither during production nor during the application contain or release any environmentally critical substances such as PFOA (perfluorooctanoic acid). The impregnation is produced on a fluorine-free polymer base [6]. In recent times fluorine-free polymer replaced the fluorine polymer in water repellent finishing. Zelan R3 newly developed durable water repellent finishing agent for fabrics, textiles, and nonwovens. It is produced from renewably sourced, non-fluorinated, plant-based material that can be replenished naturally over time [7]. Cotton can be dirtied by oily stains or oily soil. However, because cotton fibers are more hydrophilic in nature, oily stains and oily soil are more easily removed from cotton fabrics, due to a greater affinity of the fabric for water [8]. Soil-release agents increase the hydrophilicity of the fiber surface and enhance diffusion of water and hydration of the soil-fiber interface [9]. During application, the Zelan R3 surrounds each fiber with an invisible protective film. This film is responsible for achieving the highest durability for soil release clothing [10].

MATERIALS & METHODS

Materials used in finishing are

- Zelan R3
- Water
- Acetic Acid

Dye Bath Preparation

- Adjust pH of water bath with acetic acid to between (4.0 –5.5).
- If using combined with extenders, fillers, or additives, dilute each and add to the water bath.
- Dilute Zelan R3 with an equal amount of cold water, and add to the bath last.

Application to Fabric

- PH of the prepared bath: Between (4.0 and 5.5)
- Typical padding liquor pick-up of approximately (40–80) %, based on the fiber
- Bath temperatures of (20–30) °C (68–86 °F)
- Drying at (110–130) °C (230–266 °F)
- Separate curing: 5 min at 150 °C (302 °F) on curing Machine or
- Rapid curing process: 45–60 sec at 110–170 °C (230–338 °F) in stages (Stenter Machine)

Water Repellency Test Method

Water sprayed on the fabric surface of under controlled conditions produces a wet surface whose size depends on the relative repellency of the fabric. Evaluation is accomplished by comparing the wetted surface with the standard chart. Water repellency test is done with AATCC Test Method 22-2010, Water Repellency: Spray Test.

Apparatus

- AATCC Spray Tester, see 8.1
- Standard Spray Test Rating Chart, see 8.1
- Beaker
- Distilled Water
- Test specimen 18 cm x 18 cm (7 x 7 in.) conditioned at 65 +/- 2% RH and 21° +/-1C (70° +/- 2F) for minimum of 4 hours before testing.

Standard Rating

Table 1

Rating	Evaluation
100	No sticking or wetting of upper surface
90	Slight random sticking or wetting of upper surface
80	Wetting of upper surface at spray points
70	Partial wetting of whole of upper surface
50	Complete wetting of whole of upper surface
0	Complete wetting of whole upper and lower surface

RESULTS & DISCUSSIONS

Oil & Water Repellency Test

Three fabric samples were tested (Light Blue, Yellow, and Dark Blue).

Table 2

Substrate 100% Cotton Single Jersey Knit Fabric	Light Blue	Yellow	Dark Blue
Initial	100	100	100
After 20 home laundering	80	80	80

Laundering is done as per EU Home Laundering method. Tumble Dried-Ironed.

This result explain good water repellency property of the all three fabric sample.

TCHIBO Soil Release Test

Fabrics were stained & kept for 20-24 hours undisturbed with Mud, Grass, Tomato Ketchup & Tea were treated as per TCHIBO Stain Release test method & washed as per AATCC 130.

Table 3

Substrate 100% Cotton Single Jersey Knit Fabric	Stage	Light Blue	Yellow	Dark Blue
Mud	Initial	4.5	4.5	4.5
	After 20 HI	4	4	4
Grass	Initial	4	4	4
	After 20 HI	4	4	4
Tomato Kethup	Initial	4.5	4.5	4.5
	After 20 HI	4	4	4
Tea	Initial	4	4	4
	After 20 HI	4	4	4

- **HI**= Home laundering

So here positive result has found in soil release test. Fabrics have shown good soil release property through the finishing treatment.

CONCLUSIONS

ZELAN R3 able to provide consumers in 100% single jersey knit fabrics with durable water-repellent, oil repellent and stain properties in fabrics utilizing an environmental sustainability finishing treatment. Water repellent & soil released finishes increased the value of a fabric. It can be used for sportswear, children wear and for functional clothing. ZELAN R3 finish is said to effectively repel water, oil and common water-based liquids such as fruit juice, hot coffee and red wine. It is treated to perform well on a variety of fabrics, including cotton, synthetics and blends, and is ideal for high-performance outdoor and outerwear fabrics. This chemical provides an excellent water, oil and stain properties without making the fabric stiff and not hampering the fabric dimensional stability, breathability and comfort.

REFERENCES

1. P05 Water Repellency Project(November 2012),“Durable Water and Soil Repellent Chemistry in the Textile Industry” – A Research Report [1].
2. <http://www.fibre2fashion.com/industry-article/2532/water-and-oil-repellant-finishes?page=1> [2]
3. https://en.wikipedia.org/wiki/Durable_water_repellent [3]
4. <http://www.sciessent.com/water-repellent>[4]
5. Hastbacka, Mildred, “Non-fluorinated Omniphobic Coatings for Stain Resistant Textiles”, February 29, 2016. [5]
6. https://www.cht.com/cht/web.nsf/id/pa_zerof_en.html [6]
7. https://www.aafes.com/qualityassurance/TM_A-17.htm [7]
8. Marino S. Basadur, Cincinnati, “Process for imparting renewable soil release finish to polyester-containing fabrics”, Oct. 12, 1976 [8]
9. Erik Kissa, “Mechanisms of Soil Release” August 1, 1981 [9]
10. <http://www.bpt.archroma.com/products-services/finishing/repellency-soil-release/> [10]